Satyaspeak

DCIF Broadband Seminar

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Convergence of Blockchain,IPv6,IOT,AI & Data Space

Creating BlockVerse-Ubiquitous Phygital Public Good

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Gyan Vahini
Unlocking Backbone Capacity

Components of Digital Infrastructure:

Digital Infrastructure is actually 'Phygital' and Fragmented but not Ubiquitous and is highly Under-utilysed

- Towers/ BTS (IBS, DAS, active elements viz. RAN, Small Cells)
- Optic Fiber Networks (OFC)- Digital Transport Infra
- Wireline Infra
- Public Wi-Fi Hotspots
- SatCom - GEO, MEO, LEO, Nano
- Digital Public Infrastructure(DPI)- eg. India-Stack – Adhaar, UPI, ONDC, COWIN, Digilocker, Digital Signature Certification (PKI), Bhashini, e-Sanjeevani, PM-WANI, IPv6-Dual Stack, GITA (GPT), Visvasheya NBF.

Spillover Effects of Digital Infrastructure on Digital Economy

Impact of Digital Infrastructure on GDP

- Improving the digital infrastructure will help achieve the goal of doubling the GDP over the next five years through increased usage of ICT. [1]
- Increased revenues from GST, license fee, SUC, spectrum auctions, corporate and property taxes.

Impact of Broadband penetration on GDP

- Of all ICTs, Broadband has the biggest economic impact.
- 2.5 to 4.0 additional jobs for each new Broadband job.[2]
- GDP per capita growth is 2.7 to 2.9 percent higher after the introduction of broadband.[3]
- Doubling Broadband Speed adds 0.3 percent to GDP growth.[4]

Impact of Apps on GDP

- Given that, the Indian economy is expected to be around $6,600 Bn by 2030, the app spending is likely to contribute around 12% of the GDP, according to a report by Broadband India Forum.
- The growth in app economy is around 32%, more than four times the GDP growth.

Sources: 1. icrier.org/pdf/open_Internet.pdf

[2]Broadband strategies handbook, Kelly & Rossotto, 2012, available at https://openknowledge.worldbank.org/handle/10986/6009

Most of Spillover Effects of Digital Infrastructure Accrue to State, Local Governments & Citizens

Route Km of OFC-By Operators/IP1s in India(June2023)

Operator	Route Km of Optic Fiber Cables
BSNL	8.00 lakh Kms
Reliance Jio	11.00 lakh Kms
Vodafone-India	3.00 lakh Kms
Bharti Airtel	3.50 lakh Kms
BBNL (BharatNet)	7.00 lakh Kms
RailTel	0.50 lakh Kms
PGCIL(PowerTel)	1.40 lakh Kms
GAIL (GAILTEL)	0.10 lakh Kms
Others	2.5 lakh Kms
TOTAL	**37.0 lakh Kms (50% Govt./PSUs)**

Key Challenges for Digital Transport Infrastructure-India

Operational Challenges

- Fragmented deployment
- High RoW Charges
- Lack of Harmonized Policy Implementation
- Outdated O & M systems unable to achieve SLA and Availability
- High Taxes & Levies

Funding Issues

- Non-Core Infra Status of segment
- Funding constraints

Challenges relate mainly to ROW Clearances, O&M and Funding

CONSOLIDATION OF DIGITAL TRANSPORT INFRASTRUCTURE

Need of the hour is pooling of all fiber assets in a National Transport Grid under the supervision of National Fiber Authority by using the mechanism of Functional Separation.

This will generate much needed revenues from dormant/under-utilized assets and could prove to be blessing to the stressed telecom sector.

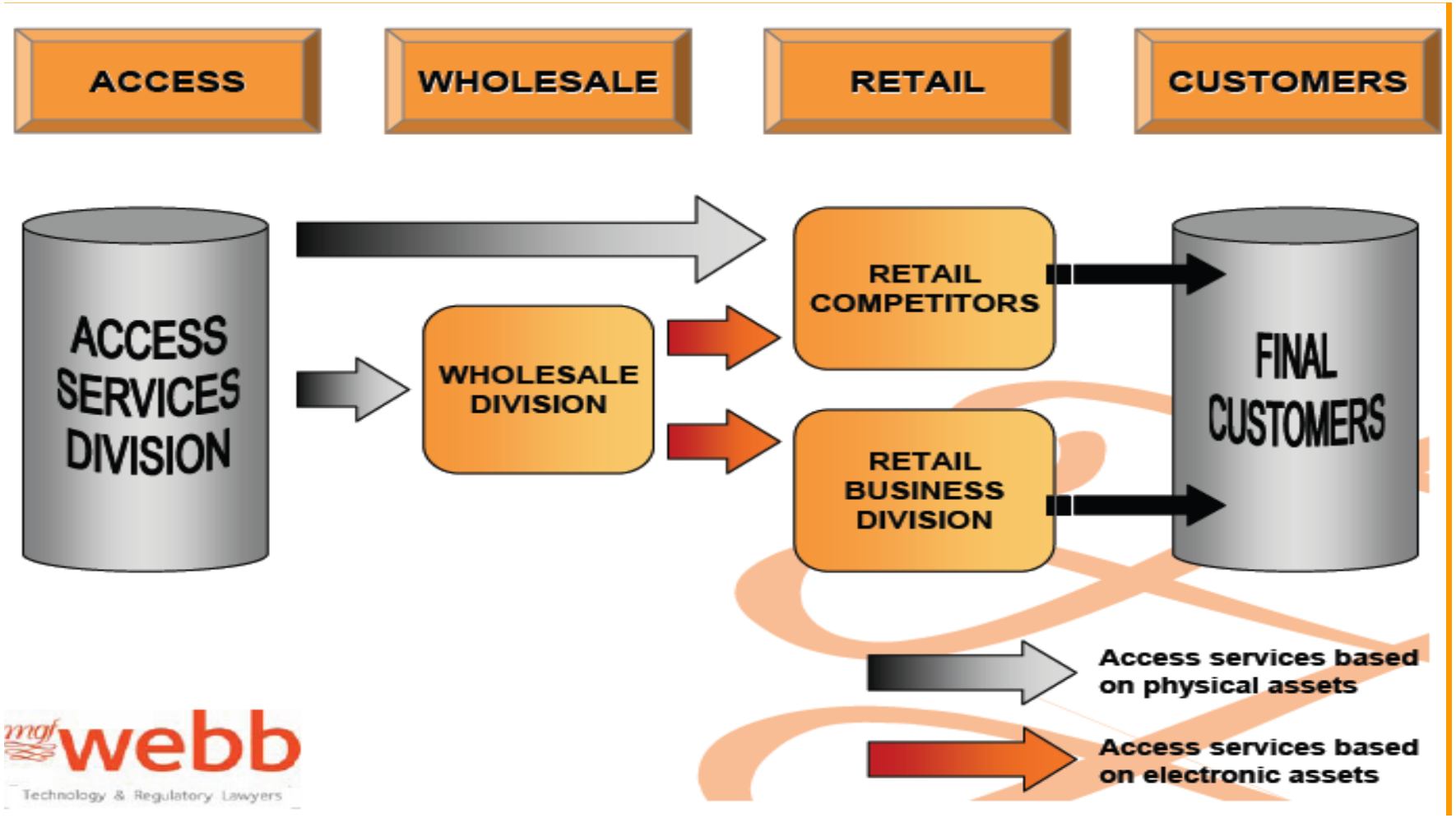
Creation of Digital Public Infrastructure Grid

Digital Public Infrastructure Grid can be created by pooling the existing backbone infrastructure of various Telcos, upgrading it and managing it through mechanisms of:

1. **“Functional Separation”**
2. **“Active-Sharing”**
3. **“IRU- Indefeasible Right of Use (Connectivity-as-a-Service-Model)”**
4. **“Blockchain Cooperative, Smart Contracts and Tokenisation powered by IPv6”**
5. **“Concept of Data Spaces”**
6. **“Funding through Infrastructure Investment Trust (InvIT) & Crowd–Sourcing” *(like– Rel.InvIT, IndGrid, REIT, NHAI Invest Trust)***

Functional Separation

– A Game Changing Approach for Unlocking the Potential of Backbone Infra



mgf webb
Technology & Regulatory Lawyers

Active Sharing

- **Telecom, being a capital expenditure intensive business, needs huge investment year-on-year for growth and expansion.**
- **Sharing infrastructure allows telecom sites to host active network components of multiple telecom service providers.**
- **Infrastructure companies generally provides an Integrated Neutral Host Platform that is used by diverse and often competing operators helping build a unique, scalable and successful business model for Telecom.**
- **Under this model, the telecom infrastructure is being shared with the operators on a non-discriminatory, transparent and in a cost-effective manner.**
- **Results in a Win – Win Situation for Tower Companies & Customers – Rate for space and energy gets reduced by approx. 20% for both operators when second operator comes on board.**

Reduced Capital Expenditure

Reduced Operational Expenditure

Faster Time to Rollout Services

Cost & Energy Efficiencies

Increased Connectivity

Safety & Improved Aesthetics

Reduces Entry Barriers

IRU(Indefeasible Right of Use) – Life-time Lease

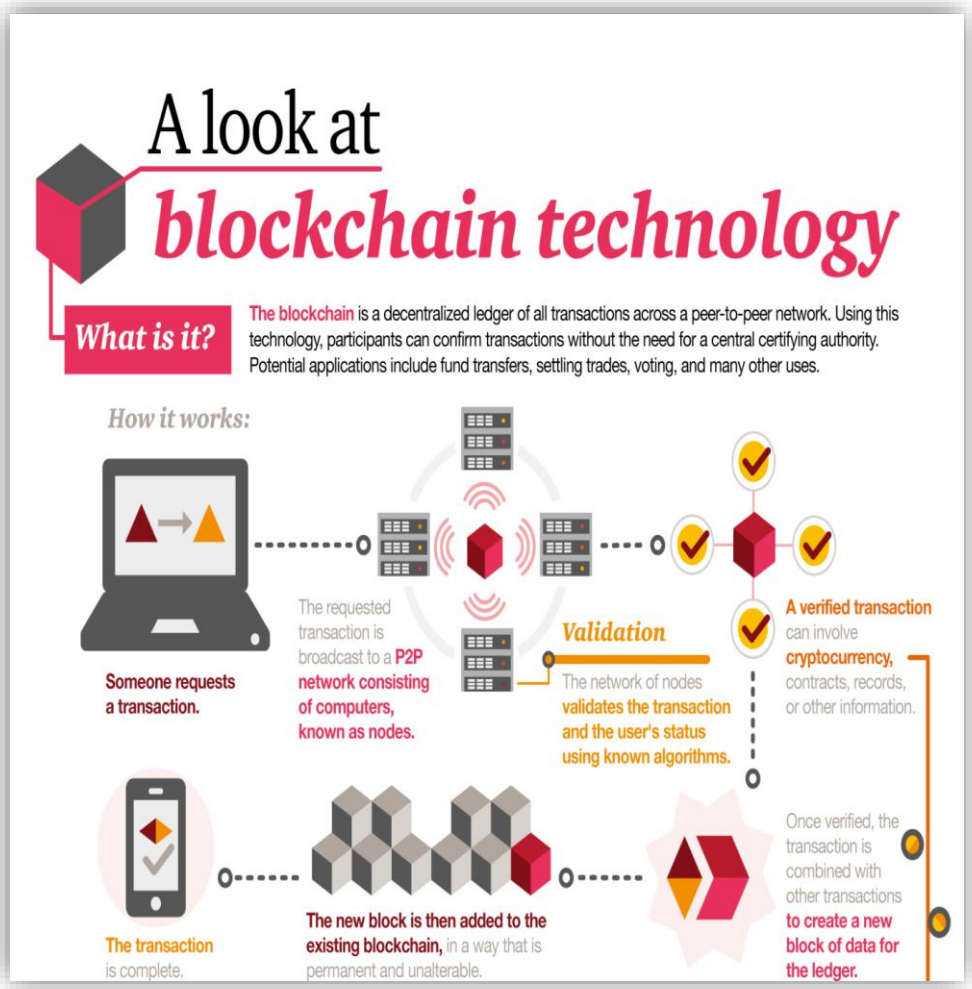
IRU means the long term right to use of capacity

IRUs are based on the concept of network sharing

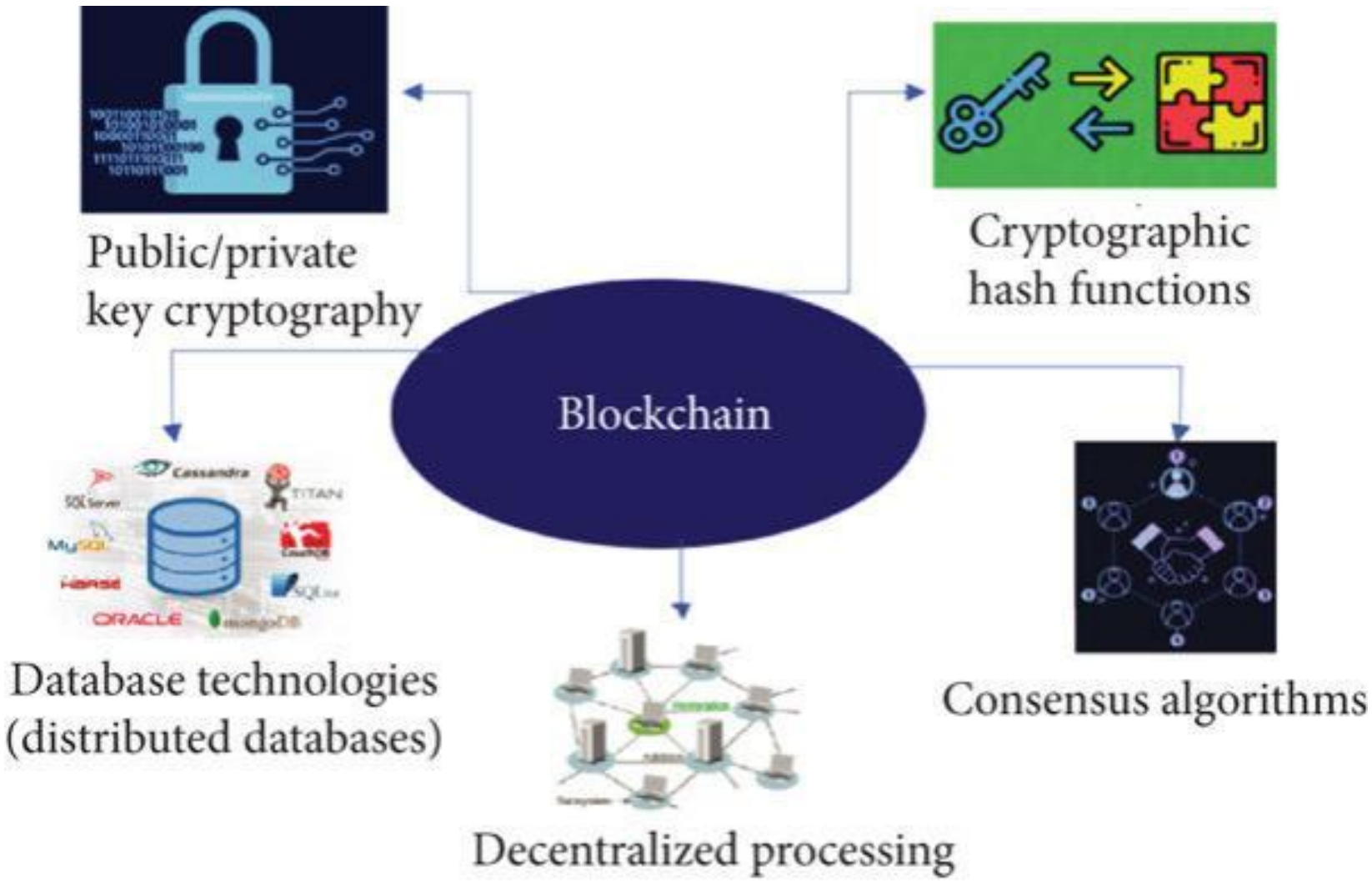
- **Indefeasible right to use(IRU) is an irrevocable right bestowed upon the client by the owner.**
- **IRU is a contractual grant of usage rights or a contractual agreement between the user and the owner for an exclusive, unrestricted, irrevocable and life-long right to use the relevant facility for any legal purpose for a defined period.**
- **The transport cables are subdivided into parts and indefeasible right to use a part is given as a life-long irrevocable lease.**
- **Such part remains an independent part from usage perspective logically, but is not physically separate on the whole.**
- **There is sharing of capacity on the whole and independent usage of the part, yet the control over the entire asset is not passed to each of the users.**

What is Blockchain?- Internet of Value(IOV)

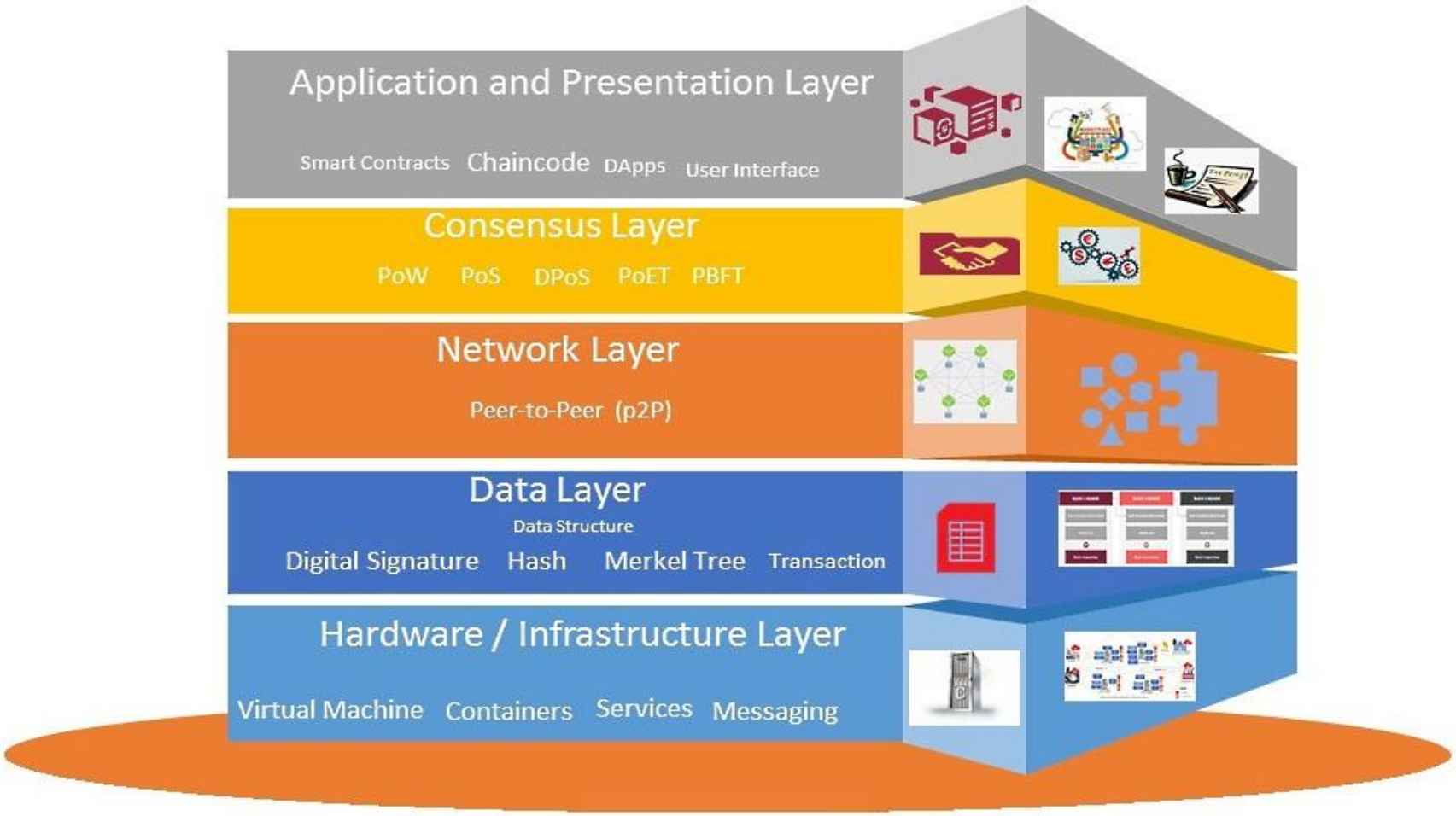
- Blockchain is a Digital Infrastructure where a Distributed Digital Ledger is maintained and shared by a network of computers or Nodes.
- In this, information of a financial or non-financial transaction is shared with a Decentralised Network and Validated by the majority of Network (Consensus).
- Blockchain Infrastructure, not being managed Centrally, effectively reduces the chances of data manipulation and leaves lesser scope for mishandling of the system by anybody as well as making it Efficient.
- It brings Transparency, Traceability and Trust to the Transactions through Immutability and Cryptography.



5 Pillars of Blockchain Ecosystem



Blockchain Infrastructure Architecture- 5 Layers of "Internet Of Value"



Power of Smart Contract

- Smart Contracts are code written into a blockchain that executes the terms of an agreement or contract from outside the chain.
- It automates the actions that would otherwise be completed by the parties in the agreement, which removes the need for both parties to trust each other.
- Smart Contracts are apps on a Blockchain that make each side of a transaction complete its part. For example, a Smart Contract could initiate a fund transfer with a third party to verify that the transfer took place.

How Smart Contract Works

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Concept of Blockchain Cooperative(DAO)

A Cooperative is "an autonomous association of persons united voluntarily to meet their common economic, social, and cultural needs and aspirations through a Crowd-owned and democratically managed Social Enterprise".

Blockchain framework offers a distinct one-on-one overlap with the underlying principles of a Cooperative setup:

- Voluntary Organization
- Collaborative Financial Structure
- Consensus in Governance and Protocol
- Regulatory Compliance
- Peer-to-Peer Interaction
- On-Chain & Off-chain Collaboration b/w Cooperatives

IPv6 – The New Internet

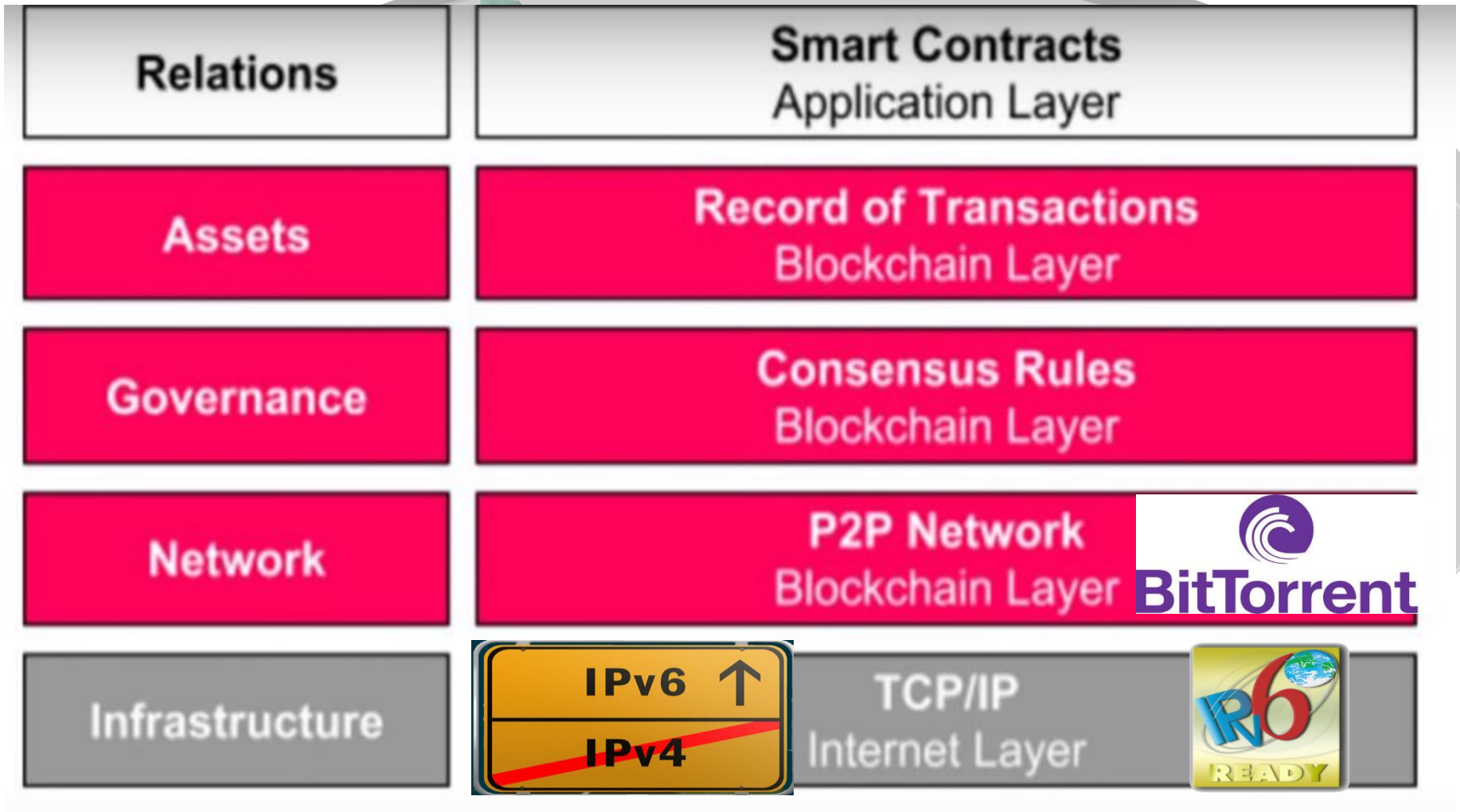
IPv6, the new version of IP, is playing a critical role in Internet development, providing new services and business opportunities for large-scale IP network applications - including Smart phones, Smart cities , Smart grids, Next Generation Networks, 5G, 6G, Blockchain, IOT and Cloud Computing – all of which are driving unprecedented demand for IP addresses;

- **IPv6 has massive address abundance.**
- **IPv6 based networks are easier to manage.**
- **IPv6 ensures end-to-end transparency.**
- **IPv6 has improved security features.**
- **IPv6 has improved mobility capabilities.**
- **IPv6 facilitates innovation and collaboration with 5G/6G, Blockchain, AI/ML and IOT.**

Improving Security and Reliability with IPv6

- Multiple subnets make it easier to separate functions and people.
- IPSec, a powerful security facility is built-in within the IPV6 protocol;
  - IPv4 does not incorporate many significant security features, whereas IPv6 includes packet encryption ie. ESP (Encapsulated Security Payload) and addresses authentication AH (Authentication Header). This makes it more secure than its predecessor .
- Absence of NAT (Network Address Translation);
  - Makes everything much more visible and E2E(P2P).
  - Security moves to the end hosts and self-managed.
  - Blockchain based CGA(Cryptographically Generated Addresses) prevents spoofing.

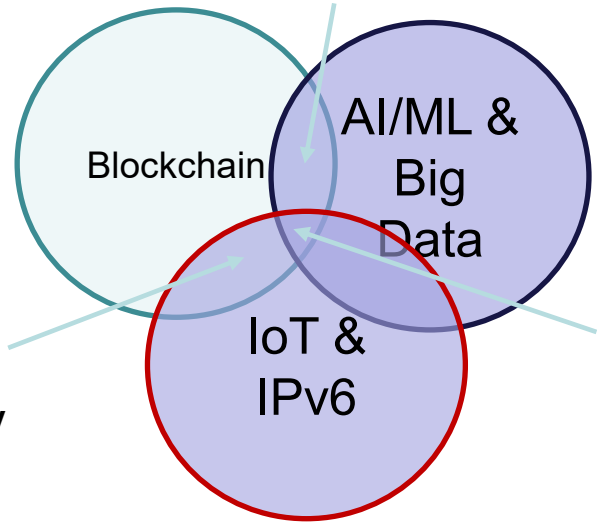
Blockchain is P2P:
Needs end2end Secure Routing:



What's next? - Blockchain + AI + IoT+ IPv6

In near future, Blockchain in combination with Artificial Intelligence (AI)/ML , Internet of Things (IoT) and IPv6 is anticipated to create new Business Models/Opportunities.

Chain Data Analytics , Decentralized AI (DAI)



IoT, M2M Transactions
Blockchain for IoT Security
Blockchain for IoT Data Management

Data Marketplace
Decentralised, Autonomous Systems-> Web3

Blockchain, AI, IPv6 and IoT integration - Convergence towards Web 3.

- Blockchain (IOV) is hugely compatible with the Schema of the Internet of Things (IoT).
- Blockchain can support IOT Ecosystem through-
  - Creating records of interactions and transactions between machines.
  - Solving problems around security as well as scalability due to decentralised, automated, encrypted, and immutable nature of Blockchain ledgers and databases.
- Also, the New Internet (IPv6) which can provide unique IP addresses to everything/each particle in the universe can help Blockchain to create, store and transfer more values making it a true De-centralised, Autonomous, Owned Internet of Wealth (Web 3).

Emergence of Data Space

Data Space is an architecture, facilitating a secured and privacy preserving, IT management infrastructure to pool, access, process, use and share data.

As per Open DEI it is defined as “A decentralised infrastructure for trustworthy data sharing and exchanges in data ecosystems, based on commonly agreed principles”.

Data Space ensures Data Sovereignty, so that the Creator and Owner of data, controls, manages, monetise and protects it.

The main element for Data Space is called a “Connecter” which is used as the interface of the data provider and data consumer to Data Space infrastructure after the auto-authentication and validation of the users.

Data Space also employs the Smart Contract attribute of Blockchain to auto-implement the agreed rules and policy for data exchange between two users. By using Blockchain attributes the Assets are Tokenised to increase the Value and players(Creators/Owners Users are Connectorized to have Control.

Data Space actually, fortify the data of any Creator/Owner in a totally democratised and decentralised manner so that the data owner has full control and self-protection of data (a sort of Lakshman-Rekha).

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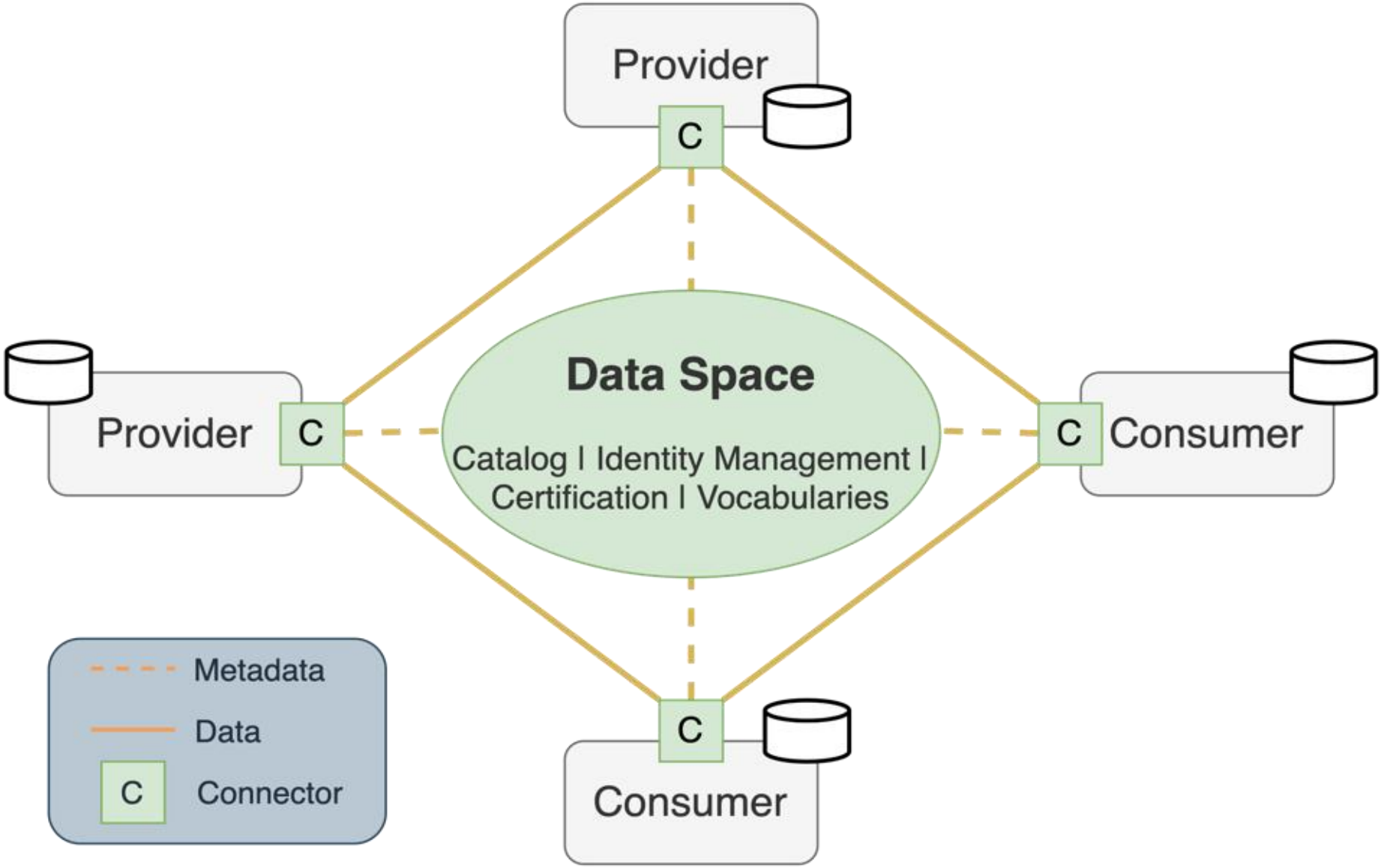
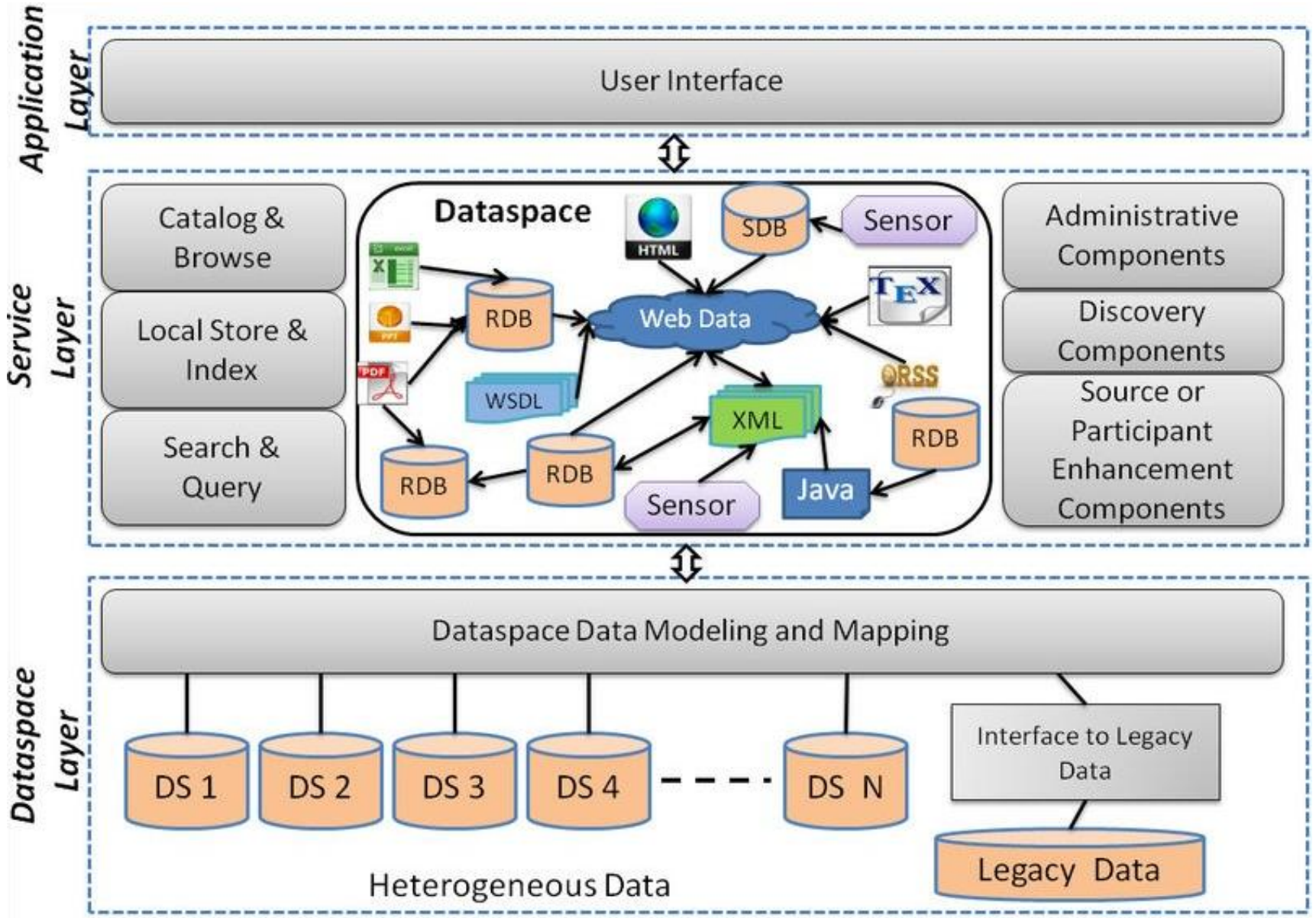
Data Spaces (DS) Concept



Data Spaces(DS) Management System Architecture



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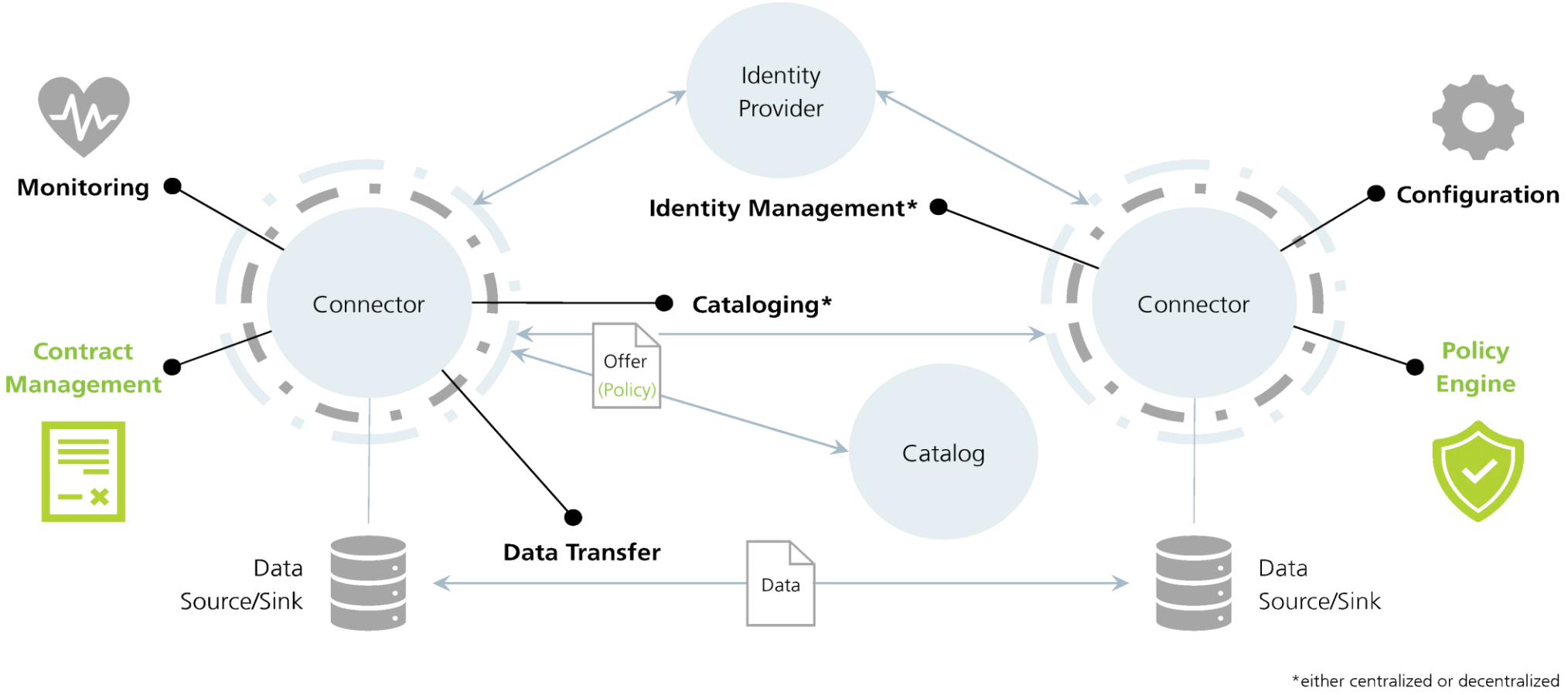
Technical Overview of Data Spaces (DS) “Connector” Interface



One of the most visible DS projects is the Eclipse Dataspace Components (EDC), an open-source project hosted by the Eclipse Foundation which is actively developed by several organizations with support from the community. EDC aims to provide a scalable and extensible architecture that will implement the DS standard as well as relevant protocols. "Connector" is scalable and extensible so that it can support alternative protocols and accommodate different underlying hosting and data storage infrastructure services and takes care of the communication among DS participants.

5e

Technical Infrastructure for Data Spaces

Health

Industrial & Manufacturing

Agriculture

Finance

Mobility

Green Deal

Energy

Public Administration

Skills

- Driven by stakeholders
- Rich pool of data of varying degree of openness
- Sectoral data governance (contracts, licenses, access rights, usage rights)
- Technical tools for data pooling and sharing

Personal data spaces

High Value Datasets from public sector

Technical infrastructure for data spaces

- Edge Infrastructure & Services
- Cloud Infrastructure & Services
- High-Performance Computing
- AI on demand platform
- AI Testing and Experimentation Facilities

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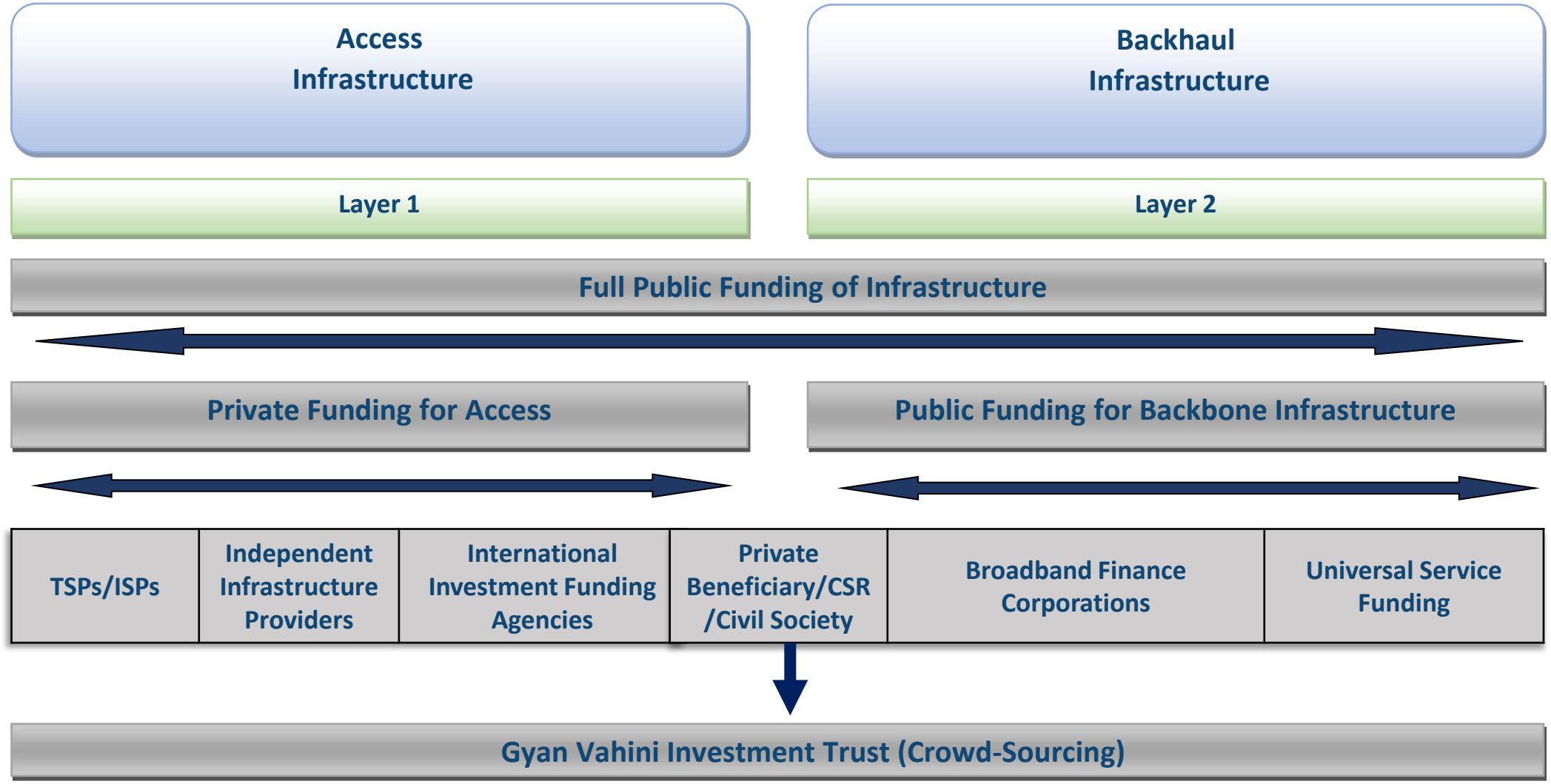
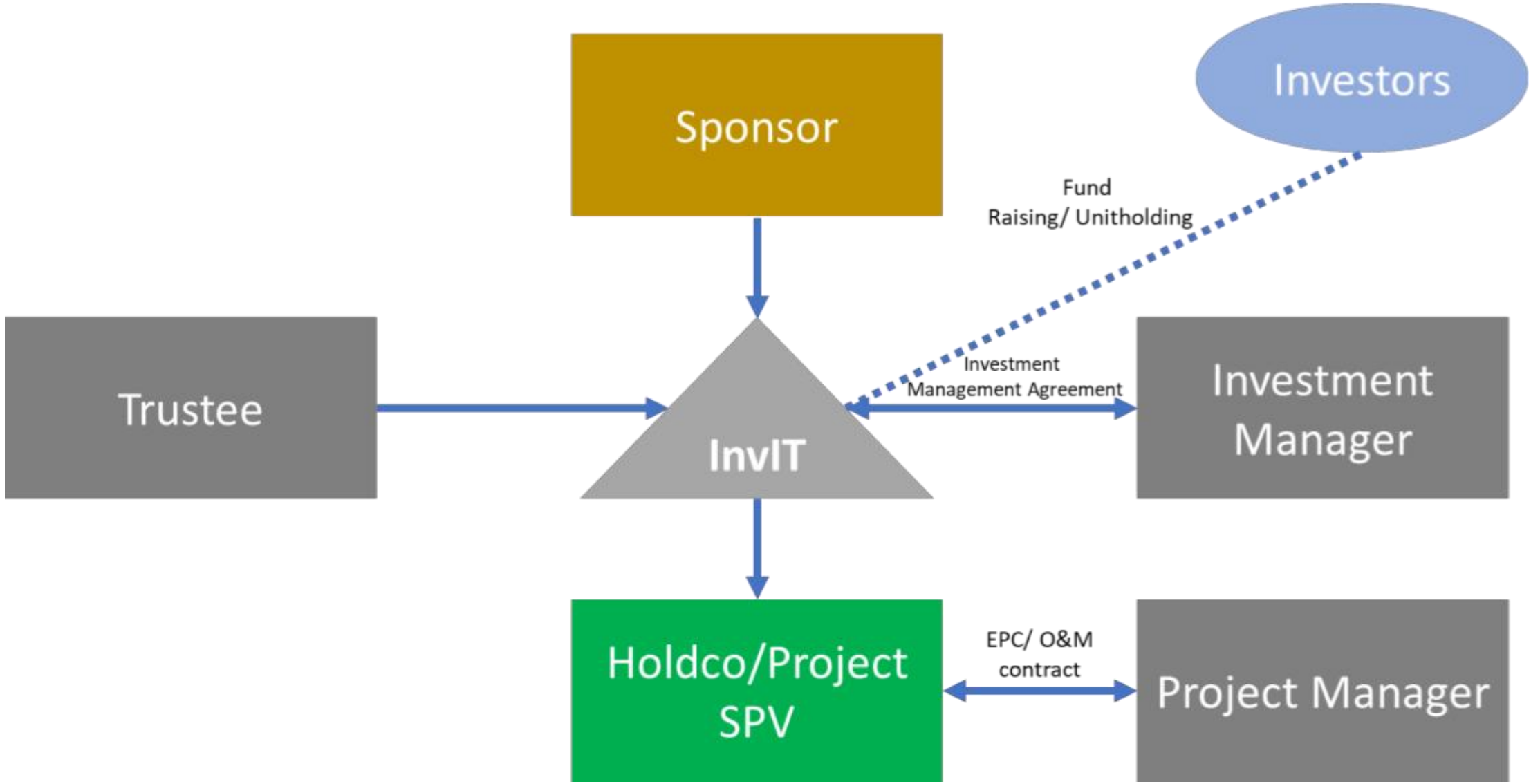
Funding Options for Phygital Public Infrastructure Based on Analogy from Alberto - Emerging models of Public-Private-People Interplay



Generic Concept of InvIT



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Gyan Vahini InvIT Concept

GYAN VAHINI INFRASTRUCTURE INVESTMENT TRUST (GV InvIT)

GYAN VAHINI BLOCKCHAIN COOPERATIVE (Assets Managing SPV)

FUNDING MANAGEMENT (Crowd-Sourcing)

- i. *Promoters/ Trustees/CSR*
- ii. *International Infrastructure Investment Agencies*
- iii. *Broadband Venture Fund*
- iv. *Telecom Debt Bonds*
- v. *Universal Service Funds*
- vi. *International Pension Funds*
- vii. *IRU Users/ Beneficiaries*
- viii. *Independent Infrastructure Investors*
- ix. *Retail Unit/ Token Holders*

GOVERNMENT/ PUBLIC ASSETS

- *PSU Telco's Backbone Infrastructure*

PRIVATE ASSETS

- *Private Telecom Companies / ISPs / LCOs (Network Assets)*
- *MSP (Managed Service Providers)*
- *Independent Infrastructure Provider*
- *OEMs / Vendors*

GYAN VAHINI (National Knowledge Transport Grid - NKTG) –

Win-Win Solution for Digital Transport Infrastructure Challenges in India

i. Gyan Vahini Infrastructure Investment Trust (GVInvIT) can help public (Govt.) infrastructure providers/telcos/network operators like: BSNL, BBNL, RailTel, Power Grid and GAILTEL and Pvt. players in monetising their Optical Fiber/Backbone infrastructurs assets as well as turning the spare capacity of their core network into additional revenue streams, thus creating Value for Stakeholders, Wealth for Nation and plenty of Jobs for skilled workforce.

ii. It will create a much-needed seamless Nation-wide Digital Backbone Network by making maximum use of the existing infrastructure.

iii. It will help in unlocking the potential of the optical fibre assets of the public sector players like: BSNL, BBNL, RailTel, Power Grid and GAILTEL and eventually turning-around BSNL which has been diving fast in losses due to under-utilisation of its assets.

iv. It will help, in improved operation and maintenance of the transmission network to meet the SLAs & Uptime requirements.

v. BSNL/BBNL/Railtel/Powertel/Gailtel/Vodaldea will be able to get Capex debt against these assets without any sovereign guarantee.

What “Gyan Vahini” will achieve?

- Gyan Vahini (NKTG) will be responsible for managing the pool of shared digital infrastructure - more precisely the fiber networks used by service providers (Telcos & ISPs), including that of PSUs.

- Gyan Vahini (NKTG) will not sell any equipment/device or broadband or any services directly to the end user (such as individuals). Instead, it will work on behalf of network owners (such as Telcos & ISPs) to maintain their shared pool of infrastructure.

- When an individual takes out any service contract with a provider that uses the NKTG network (for example, the services of Telcos or ISPs), the contract is with the retail provider (the service provider), not NKTG itself.

- National Fiber Authority (NFA) will set rules that requires Gyan Vahini (NKTG) to allow service providers to use the digital infrastructure pooled network to provide services to consumers.

- Retail communications providers will pay charges (called wholesale local access charges) to Gyan Vahini (NKTG) to use the common pool of infrastructure managed by it and National Fiber Authority will administer its functioning.

- This all management will be facilitated with help of Functional Separation, Indefeasible Right of Use (IRU), Smart Contracts and Blockchain Cooperative concepts.

Conceptual Business Canvas
'GYAN VAHINI' (NATIONAL KNOWLEDGE TRANSPORT GRID – NKTG)

KEY PARTNERS

- Govt. Telcos (BSNL, BBNL, RAILTEL, POWERTEL, GAILTEL)
- Pvt. Telcos (RJio, Airtel, Voda-Idea, Tata Communication, RCom)
- IP-1 Companies (ATC, VIOM, GTL etc.)
- ISPs
- Managed Network Service Providers
- USOF (Universal Service Obligation Fund)
- OEMs

KEY ACTIVITIES

- To form a Cross-Industry Joint-Stock Consortium (SPV)
- To take stock of the Existing Infrastructure (GIS map, Capacity Route.Km)
- To provide existing capacity utilisation & spare capacity data
- Create open-access National Digital Infrastructure Grid

KEY RESOURCES

- Existing Fibre-based Ground Infrastructure
- Existing Radio Based Transmission Infrastructure
- Existing Tower Infrastructure
- Data Centres
- NOCs
- MSAN – Multi Service Access Nodes (Point of Presence)

VALUE PROPOSITION

- To offer Digital Connectivity Anywhere, Anytime, Any-Capacity to Telcos, ISPs, Enterprises, End Users.
- To make use of idling/under-utilised resources
- To create employments for specially skilled manpower
- To generate Entrepreneurs in rural-areas as VLEs & Franchisees

CUSTOMER RELATIONSHIP

- Blockchain Based Smart Contracts
- Initial Token Offer (ITO)

CHANNELS

- Franchisees
- Agents
- Digital Electronic Platform (Bandwidth Pool)
- VLEs

CUSTOMER SEGMENTS

- Telcos
- ISPs
- Enterprises
- Govt. Bodies
- End Users

COST STRUCTURE

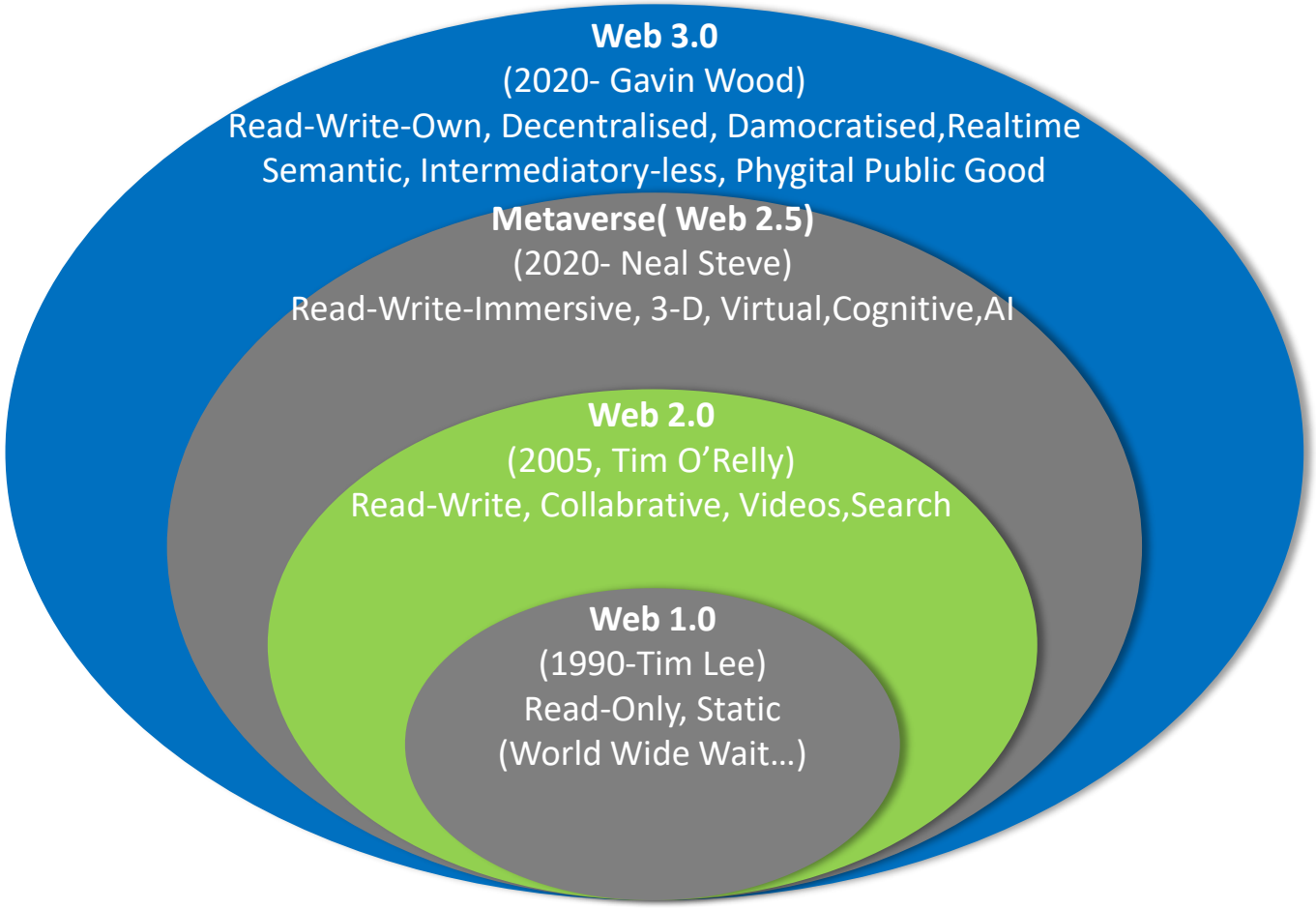
- Notional Valuation of the Spare Capacity contributed by the key partners, quantified through MIU*Km measure
- Network Upgradation Capex
- O&M Costs
- Specialised manpower including Blockchain Experts

REVENUE STREAM

- IRU pre-sale of capacity to Telcos, ISPs & Govt. Bodies
- Annual/Long-Term lease of capacity to Enterprises
- Retail sale of capacity through Channels

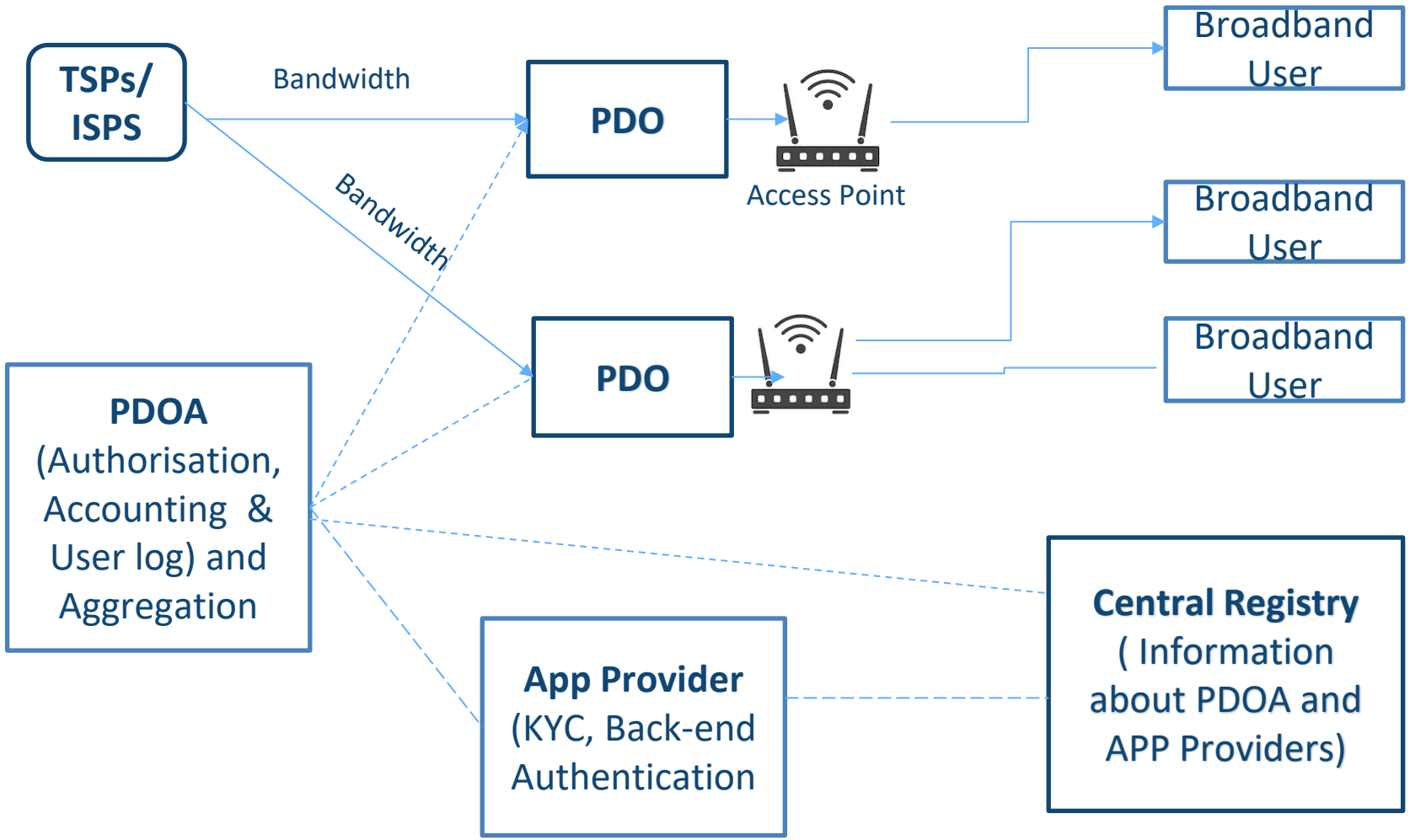
STRATEGYZER Business Canvas

Evolution Toward Web 3.0 (Internet of Owned Wealth)

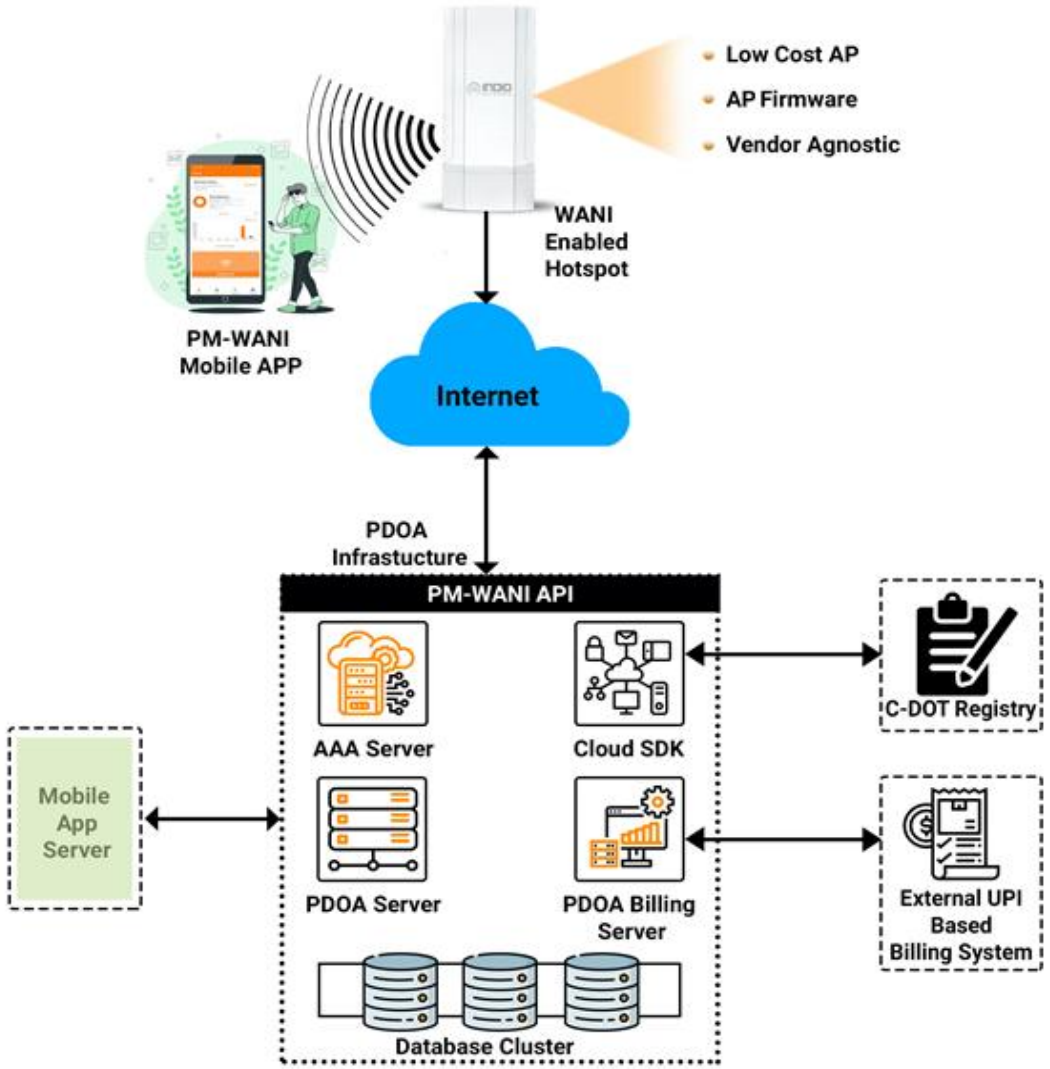


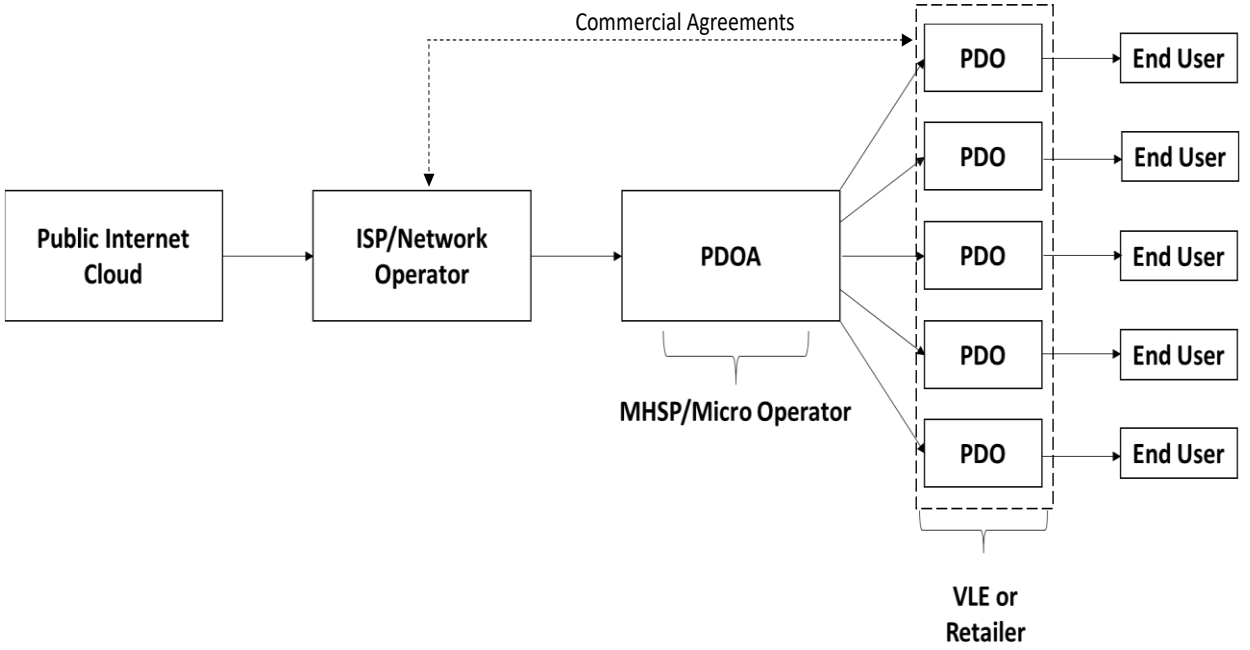
PM-WANI: PRIME MINISTER-WIFI ACCESS NETWORK INTERFACE-
A Liberalised Framework for Last Mile Connectivity(LMC)

WANI - Unbundled and Distributed Architecture



PM-WANI System Architecture

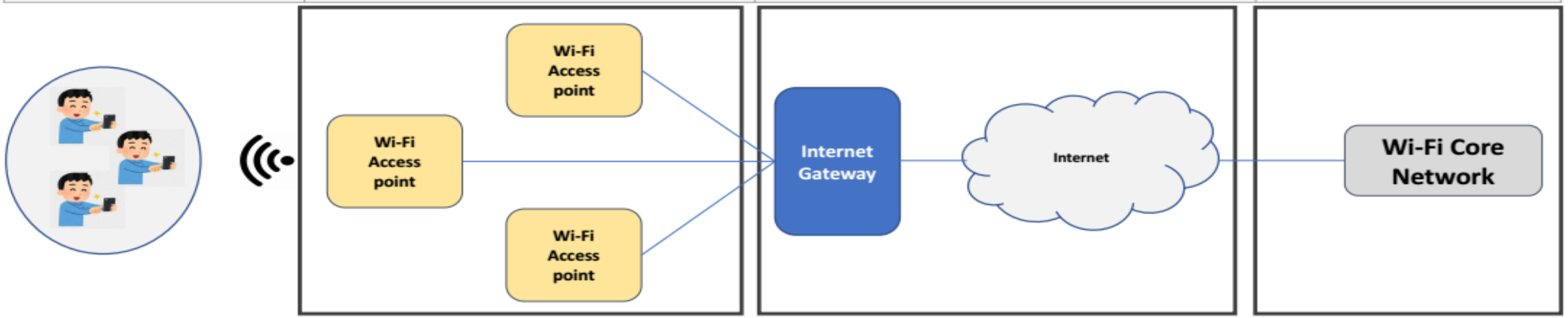




PM-WANI-- Multi-partner play for end-to-end service delivery

Deployment in India as PMWANI Program

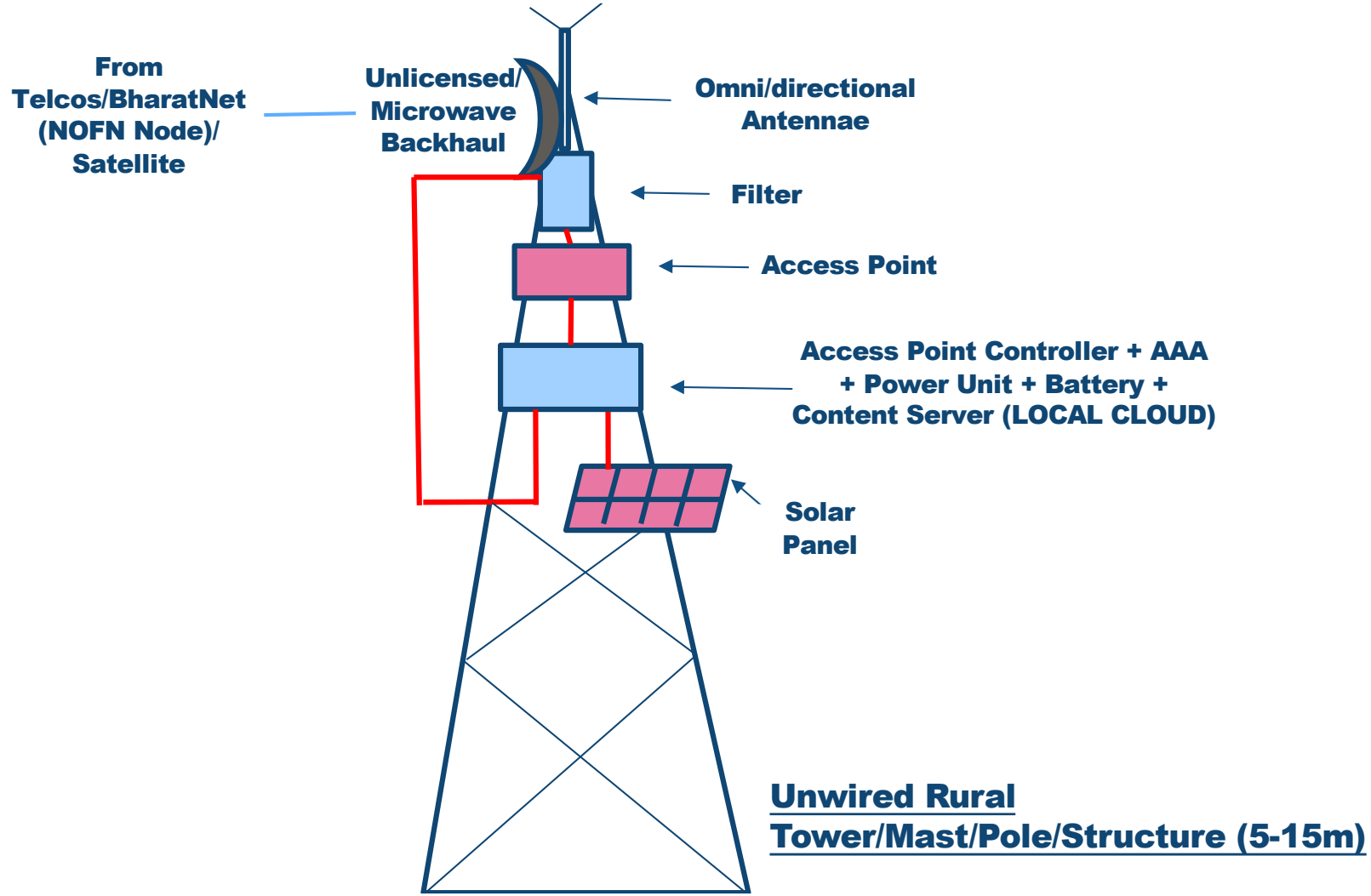
Service Provider	Wi-Fi Access Network Infrastructure	Internet Infrastructure	Wi-Fi Core Network Infrastructure
Wi-Fi VNO	**Wi-Fi VNO**	**ISP**	**MNO**
Prepaid/Postpaid Data plans	Installation of Access point, Power, O&M	Wi-Fi VNO arranges Internet backhaul from local ISPs	providing AAA, OSS, BSS functions for Wi-Fi
VLE (Village Level Entrepreneurs) or PDO (Public Data Office)	**VLE or PDO (Public Data Office)**	**Local ISP**	**Wi-Fi Aggregator or PDO Aggregator**



In this deployment scenario, New entity (Wi-Fi VNO) offers services by using its own Wi-Fi Access network infrastructure. Wi-FI VNO also arranges internet backhaul from local ISPs and takes service from MNO for Wi-Fi core functions.

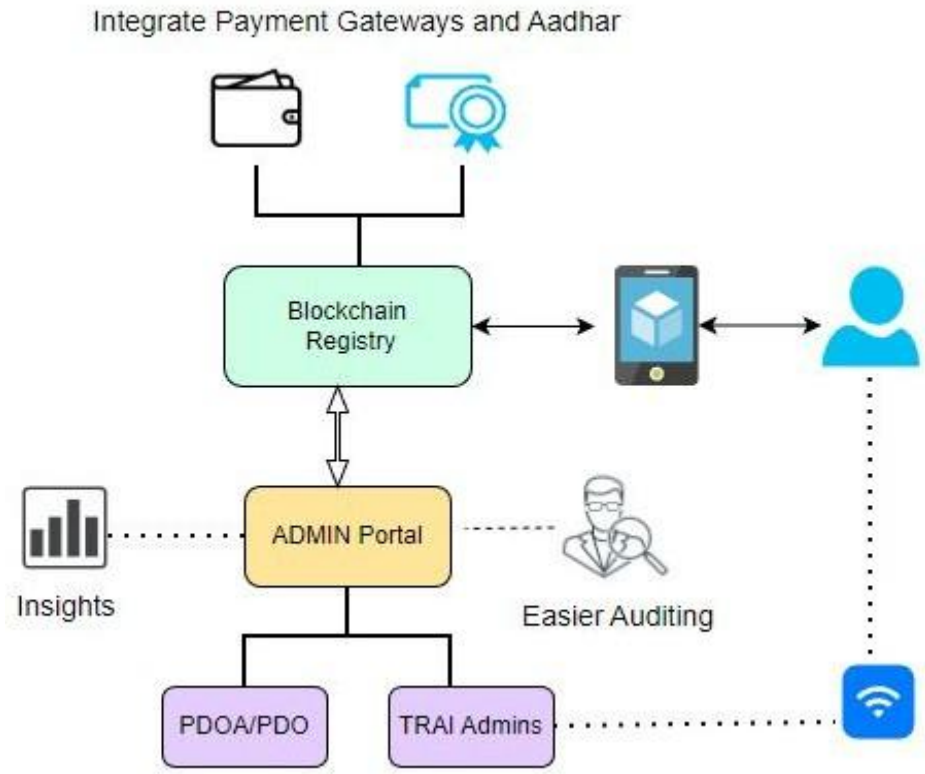
Managed Hotspot Service Provider (MHSP) as Public Data Office Aggregator (PDOA)

Value Innovation to achieve Affordability - Everything on Tower (5L- Low Cost, Low Power, Low Maintenance, Local Control, Local Cloud)



Solution Approach

- it is proposed to create a Blockchain based decentralized registry which allows sharing of necessary information among all the stakeholders/nodes.
- All the interactions will be noted on Smart Contracts, with the required validation. The Admin portal shall have role-based authentication which shall provide valuable insights.
- The portal will provide real-time information of an active User to any PDO, thus eliminating re-registering process and providing a superior User experience.
- The portal will hook with Aadhar and Payments Gateway to enable KYC and payments to the PDOAs and PDOs.



Way Forward

Moving DPI to PPG (Phygital Public Goods)	The Public Goods also known as Commons are natural resources like Air, Water, Sea, Sunlight, Open-Sky etc., which are freely available to all in non-discriminatory manner. DPI has the potential to be upgraded to PPG by Govt. and Civil Society, with innovative technology value-additions,specially Blockchain.
Pooling of Optical Fiber Networks	Government has to take initiatives to facilitate proper framework for infrastructure pooling through enabling policy and regulatory framework by creation of autonomous National Fiber Authority.
Regulatory Intervention	The Regulator/ Govt. to issue Consultation Paper or create pilot project to bring awareness and get stakeholders buy-in to the concept.
All stakeholders, Govt., Civil Society Collaboration	All the relevant players within the Digital Infrastructure value chain together with cross-industry players need to collaborate to jointly cooperate and contribute towards the creation of Digital Public Infrastructure((DPI) Grid to be upgraded to Phygital Public Good (PPG).

Thank You

“Let us create BlockVerse- Phygital Public Good, together”

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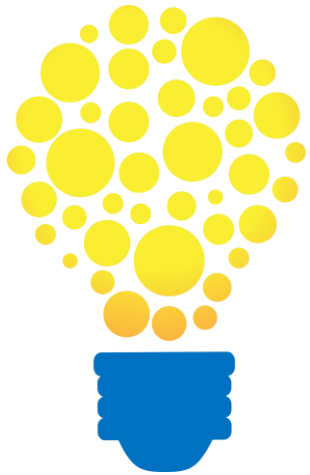

Gyan Vahini

Unlocking Backbone Capacity